Remarks

Claims 1, 3-18, 21-28 are pending. Claims 2, 19, 20 and 29 have been canceled. Claims 1, 9, 10, 14, 26 and 27 are amended hereby.

Claims 15-18 were objected to as being dependent upon a rejected base claim, but were indicated to be allowable if rewritten in independent form including all the limitations of the base claim and intervening claims. Applicant invites the Examiner's attention to the immediately previous Amendment and Remarks of 2/6/04, wherein the contingency for the allowability of claim 15 was satisfied. Prior to the amendment of 2/6/04, claim 15 depended from independent claim 14. In the prior amendment, claim 15 was amended to rewrite it in independent form and to incorporate all the limitations of base claim 14. This previous amendment evidently was overlooked. Claim 15 thus is currently in condition for allowance without further amendment, and such allowance is respectfully solicited. Claims 16-18 depend from claim 15, and thus are also allowable. Applicant also invites the Examiner's attention to claim 28, which depends, and has always depended, from claim 15 as well. Claim 28 accordingly also is allowable.

Claims 1, 8-14, and 25-29 stand rejected under 35 U.S.C. §103(a) as being unpatentable over '683 to Childs et al. in view of U.S. Patent No. 5,775,107 to Sparkman. Applicant initially traverses several of these rejections.

The Examiner disagrees (Office Action, page 2, paragraph 2) with Applicant's contention that Childs '638 does not teach a condenser. The Examiner indicates that the condenser **24** in Childs "can be considered as a condenser." This is mistaken. Childs' element **24** is denoted as a "cooler" in the patent. Childs, col. 8, lines 57-58. Importantly, all condensers may be "coolers," but not all "coolers" necessarily are condensers. The system shown in Childs' Fig. 5 is a Modified Brayton cycle engine. Childs, col. 8, lines 29-30. Brayton cycles are all-gas cycles, circulating vapors only, and no liquid. Childs, col. 7, lines 61-67. Critical to understanding the disclosure of the Modified Brayton cycle system in Childs' Fig. 5 is that "[b]y Modified Brayton cycle engine is meant one where the working fluid (*a gas or a vapor that is always above its condensation temperature*) provides power output . . . ." Childs, col. 4, lines 60-64 (emphasis added). Accordingly, the cooler **24** of the Childs disclosure is just that: a cooler. It does not condense the working fluid to a liquid, but cools the vapor for return to the heater. ("Condense" means a phase shift from gas or vapor to liquid.) The presence of a condenser in the claimed

apparatus immediately distinguishes those claims (claims 12, 13, 15-18, 27-29) which recite a condenser as an apparatus component.

More importantly, the Brayton cycle system shown in '683 Childs lacks important limitations recited in the claims, namely, "a boiler in communication with said panel, wherein thermal energy is transferred in said boiler from said fluid to vaporize a low-boiling-point working fluid, whereby said boiler outputs a pressurized working fluid vapor . . . " or "a boiler in communication with said collector, wherein thermal energy is transferred in said boiler from said fluid to vaporize a low-boiling-point working fluid, whereby said boiler outputs a pressurized working fluid vapor" (claims 1 and 14, respectively, *before* amendment). The Childs system, employing an "all-gas" Brayton cycle engine (Childs, col.7, line 61 through col. 8, line 33), has no boiler corresponding to the boiler thus claimed by Applicant.

Thus, Childs '683 uses the solar energy concentrator that directly heats the working gas, which working gas then drives the hydraulic unit. See, e.g., Childs et al., col. 7, lines 61-66, col. 8, lines 29-52. In marked contrast, in the present invention the solar collector does not boil the water that flows through it. Rather, in the present invention, the solar energy collector heats (but does not boil) a fluid, which then flows to the boiler where its heat is used to boil a low-boiling point working fluid at high pressure. Accordingly, a comparatively low-pressure liquid is moved from the solar collector to the boiler. One advantage of the invention thus is the feasibility of using a cheap fluid, such as water, to transport the collected thermal energy from the collector using comparatively inexpensive pipes. (The high-pressure vapor can then flow to the hydraulic unit via pipes that are more expensive (per unit length) but much shorter).

Because Childs does not teach the boiler limitation recited in Applicant's claims 1 and 14, those claims are patentable over Childs. Significantly, neither does the other applied reference, '107 to Sparkman, disclose the subject matter lacking from Childs. Sparkman does show a boiler (**16**), but it is not integrated into the Sparkman system in the same manner, to perform the function, set forth in Applicant's claims.

Applicant's claim 1, before amendment, requires: (1) that "thermal energy is transferred in said boiler from said fluid to vaporize a low-boiling-point working fluid, *whereby said boiler outputs a pressurized working fluid vapor*;" and (2) "an expander *responsive to the pressurized working fluid vapor* to generate an output motive force . . . ." Independent claim 14 also recites

these limitations. Although Sparkman's system has a boiler, the foregoing features are absent from Sparkman's teachings.

Attention is invited to Sparkman Fig. 1 and col. 3, lines 56-61. It is noted that instead of taking vapor from the top of his boiler, the pipe that leads from Sparkman's boiler (**16**) to his hydraulic motor (**24**) is connected to the *bottom* of the boiler tank. Because liquids are heavier than their corresponding vapors, *liquid* necessarily flows to Sparkman's motor. If the liquid does not vaporize in the Sparkman motor, his system would not work at all, because it would require as much or more energy to pump the liquid via his pump (**26**) through pipe (**12**) back to the boiler as would be generated by the liquid flowing through the motor (**24**). The Sparkman system must rely on a partial vaporization that presumably takes place in the motor itself.

In any event, it is seen that in Sparkman's system, the boiler outputs a heated *liquid* (see Sparkman, col. 3, lines 56-62), not pressurized *vapor*, as required by Applicant's claims 1 and 14. Further, Sparkman's motor is responsive to the heated liquid, whereas in contradistinction Applicant's claimed "expander" is responsive, in claims 1 and 14, to the pressurized "working fluid *vapor*" — through efficient adiabatic expansion — to generate the output motive force.

It is seen, therefore, that neither Childs nor Sparkman, nor the two publications combined, teach or suggest explicit limitations central to Applicant's claimed invention: (1) a boiler in communication with a solar collector panel, wherein thermal energy is transferred in said boiler from said fluid [now "liquid"] to vaporize a low-boiling-point working fluid, (2) whereby said boiler outputs a pressurized working fluid vapor; and (3) an expander responsive to the pressurized working fluid vapor to generate an output motive force.

The rejection of claims 1 and 14 as being obvious over the combination of Childs et al. and Sparkman thus is fully traversed. Further, Applicant submits that because Childs et al. is a closed Brayton cycle system using gas as the working fluid, and Sparkman explicitly teaches a system wherein the hydraulic motor is driven by a heated liquid, the two references cannot properly be combined as the foundation of a rejection under 35 U.S.C. § 103. A person of ordinary skill in the art would find no motivation or suggestion to modify the Childs et al. all-gas system to include the all-liquid "boiler" elements of the Sparkman device, particularly in view of the fact that Sparkman has nothing to do with desalination of water. (In Sparkman's system, if

one were to attempt to pump seawater directly, he would be using liquid from the bottom of the boiler, and when the liquid arrived at the motor/expander and began to evaporate, its pressure would plunge rapidly, due to large latent heat of vaporization, to below the pressure required by a reverse osmosis unit.)

To more expressly distinguish the claimed invention over the teachings of Childs et al., claims 1, 10 and 14 are amended. As amended, claims 1, 10 and 14 now require that the heat transfer fluid is a "liquid." Thus, in the invention, a *liquid* carries thermal energy from the solar collector to the boiler. The Childs et al. disclosure refers to only to a "fluid" which carries thermal energy to a piston or other "direct drive engine."

For the foregoing reasons, independent claims 1 and 14, as amended, are allowable over the combined disclosures of Childs et al. '683 and Sparkman. Claims 3-13 depend from claim 1, and thus also are in condition for allowance. Claims 20-27 depend from claim 14, as amended, and thus are allowable for the same reasons.

The rejection of claims 3 and 20 over Childs et al. in view of Sparkman and further in view of '513 to Young is specially traversed. Claims 3 and 20 recite that the "hydraulic motor" comprises "at least one pair of rotating pistons *in rolling contact to form a seal* to prevent fluids from flowing from a region of high pressure to a low pressure region within said hydraulic motor." (Emphasis added.) In the Young device, the oscillating rotors are not in "rolling" contact, indeed the individual rotors are not in contact at all. In lieu of Applicant's efficient rolling seal, Young resorts to frictional "sealing strips" (e.g. **106** and **206** in Fig. 1) and "end strips" (**107** and **207** in Fig. 1), which have been a serious drawback in all prior rotary engines such as Young's. Because '513 to Young does not disclose "rotating pistons in rolling contact to form a seal to prevent fluids from flowing from a region of high pressure to a low pressure region," claims 3 and 20 recite patentable subject matter.

Attention is invited to U.S. Patent No. 6,401,686, for which the Applicant is one of the named inventors. The "rolling contact to form a seal" limitation is borrowed from the disclosure of the '686 patent. The issuance of the '686 patent further supports the allowability of the subject matter of claims 3 and 20.

Claim 14 is amended to import the limitations of claim 20, and claim 20 accordingly is canceled. Because Young most certainly does not teach or disclose the features of "rotating

pistons in rolling contact to form a seal to prevent fluids from flowing . . . ." as aspects of the "hydraulic motor" useable in the claimed invention, claim 14 and its dependent claims are further placed in condition for allowance.

The rejection of claims 5, 6, 20, 22, and 23 is similarly traversed. Claims 5, 6, 20, 22, and 23 all recite "at least one pair of rotating pistons in rolling contact to form a seal to prevent fluids from flowing from regions of high pressure to low pressure regions . . ." or a close variant thereof. Since neither Childs et al. nor Sparkman nor '513 to Young disclose this limitation, these dependent claims all recite subject matter patentable over the applied art.

Claims 9 and 26 are amended to rectify typographical errors, by replacing "cylinder" with "piston." Claim 27 is amended to supply an inadvertently omitted word, helpful to clarity of the claim. Claim 29 is canceled not for any reason relating to patentability, but solely to simplify and expedite prosecution and allowance.

Amendment, examination, and allowance are respectfully solicited. In the event the Examiner has any questions or suggestions to promote the allowance of the application, he or she is invited to call the undersigned.

Respectfully submitted,

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